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REPORT ON POLLUTION OF THE NAVIGABLE WATERS OF EASTERN NEW JERSEY, SHARK RIVER TO CAPE MAY

Federal Water Pollution Control Administration
Metuchen, New Jersey

May 1967

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POLLUTION OF THE NAVIGABLE WATERS

OF

EASTERN NEW JERSEY

SHARK RIVER TO CAPE MAY

NATIONAL TECHNICAL
INFORMATION SERVICE

U. S. DEPARTMENT OF THE INTERIOR

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

NORTHEAST REGION

HUDSON-CHAMPLAIN AND METROPOLITAN COASTAL
COMPREHENSIVE WATER POLLUTION CONTROL PROJECT

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I

"..... an impressive body of evidence points to the lowlands bordering the sea coasts as an area where pollution problems merge and concentrate. In this area contamination which is deleterious to fish and wildlife resources is rarely if ever a purely local problem;....."

The President's Science Advisory Committee

November, 1955

I. INTRODUCTION

Description of Area

The study area extends from Shark River on the north to Cape May on the south, and embraces the navigable estuaries and tributaries of the Atlantic Coastal Area of New Jersey. It includes Shark River and inlet, Manasquan River and inlet, the Intracoastal Waterway, and the various bays, harbors, and streams tributary to the waterway. The study waters have a surface area of more than 115,000 acres.

With the exception of Shark River and a portion of Manasquan River, which are in Monmouth County, and a portion of Mullica River in Burlington County, the waters of the study area lie within three counties: Ocean, Atlantic and Cape May. As only a very limited portion of Monmouth and Burlington Counties is included in the study area, discussions of population, economics, and similar factors are restricted to Ocean, Atlantic and Cape May Counties.

Geology

On the basis of ground-water occurrence, New Jersey can be divided into two major geological provinces: The Highland Appalachian Valley and the Atlantic Coastal Plain. (1) A "fall line", stretching from Trenton to Perth Amboy, separates the Atlantic Coastal Plain from the northern ground-water province. The study area is entirely underlain by the Atlantic Coastal Plain Province.

The Atlantic Coastal Plain Province is a southeastward-thickening wedge made up of deposits of unconsolidated clay, silt, sand, gravel and marl of Cretaceous and Tertiary age. The wedge has a southeastward dip of about 100 feet per mile. The coarser beds in these deposits are very favorable for the storage and movement of ground water. A band six to ten miles wide along the coast identifies the area susceptible to salt-water contamination. (2)

The topography of the Coastal Plain has relatively low relief. Most of the Plain lies between sea level and the 200 foot contour.

Population and Economy

The resident population in the three county area numbered 317,676 persons in 1960, and is estimated to have increased to 371,880 by 1965, a growth of approximately 3.7 percent each year, compared with a State-wide annual rate of 2.5 percent. (3) Atlantic County is the most populous,

with slightly less than half of the area's residents. Ocean County registered the swiftest population rise, approximately 33 percent in the five-year period, 1960-1965. More than three-quarters of the inhabitants in the study area live in the cities and other municipalities fronting the Atlantic or located along the coastal bays and inlets.

An internationally famous resort area, the "Jersey Shore" attracts millions of tourists and vacationists throughout the year. During the summer season the population swells to more than triple its winter size. Table 1 illustrates the enormous influx of summer visitors to several large and small resort centers. This seasonal variation underscores the importance of tourist trade to the economy of the coastal area and points up the tremendous strain imposed upon all forms of public facilities during the summer season.

TABLE 1

SEASONAL POPULATION CHANGES AT SELECTED COASTAL COMMUNITIES (4)
1964

Resort	Normal Population	Summer Population	Population Increase	
			Net Gain	Percent
Atlantic City	60,400	210,000	149,600	+248%
Ocean City	7,730	150,000	142,270	1,840
Wildwood City	4,680	125,000	120,320	2,571
Ship Bottom	750	16,000	15,250	2,033
Surf City	450	13,000	12,550	2,789
TOTALS	74,010	514,000	439,990	595%

Source: New Jersey State Navigation Bureau.

It should be noted that the summer population gain of 439,990 for the five resorts listed above is larger than the total resident population for the three-county study area, 371,880. There are many other resort communities in the study area which experience equally dramatic increases in summer population.

An analysis of the employment pattern (wage and salary employment covered by Social Security) (5) in the three-county coastal area also characterizes it as a leading resort region. More than half of those employed are engaged in trade and service activities. Even in mid-March, the date of Census enumeration, these counties provided 43 percent of the State's total employment in hotels, motels and other lodging places. Summer employment at these facilities rises significantly to accommodate the needs of thousands of guests visiting the "Jersey Shore".

Employment in the area is growing faster than the state as a whole. Although total employment in New Jersey advanced 13 percent between 1956 and 1964, employment in the three-county area grew at more than double the State rate, with an increase of 30 percent. The study area accounted for only four percent of the State's total covered employment, but in several major employment sectors it had a relatively high ratio of the State total. Such sectors include: agricultural services, forestry and fisheries, 15 percent of the State total; contract construction, 9 percent; services, 6.3 percent and retail trade, 6 percent.

Another economic measure demonstrating the attraction of this area as a vacation and recreation area is the proportion of seasonally vacant housing units within its outline, which is one of the best qualitative measures of an area's recreational development. With only nine percent of the State's total housing units, the three-county area monopolized 61 percent of New Jersey's total seasonally vacant housing units.

On the basis of employment, the study area includes the majority of the New Jersey fin and shellfish industry. According to the Fish and Wildlife Service of the U. S. Department of the Interior, (6) New Jersey had 3,395 fin and shellfishermen in 1964, two-thirds of whom worked in the three-county study area. Of this total, approximately 1,000 fishermen were classified as casual (fishermen who earn less than half of their income in the fishing industry).

II. HYDROGRAPHY

New Jersey has a very uniform long term average monthly precipitation with about 8 percent of the annual average occurring each month. Average annual precipitation in Southern New Jersey is about 45 inches.

Although precipitation during drought conditions may be only a third or half of the maximum rainfall month, the stabilizing effect of ground water storage in the Coastal Plain results in a noticeably greater sustained dry season runoff in the headwaters region of the Batsto and Toms Rivers.(7)

The New Jersey coastal estuaries are characterized by very restricted connections with the ocean. The average depth over their barrier bars is from three to five feet (except for Cape May and Little Egg Inlets), and the bars are made impassible by breakers on many occasions. The greatest tidal current velocities are found in the inlets and may reach three knots.(8)

The northern estuaries, inside the inlets, are relatively broad and shallow, and their normal tidal current pattern and range may be greatly modified by the wind. In Barnegat Bay, for example, normal tidal range is about half a foot away from the inlets, and four feet on the ocean side, but during strong winds of long duration may vary by as much as three feet above and below normal maximum levels. The southern estuaries are characterized by relatively narrow, twisting channels connecting shallow, sedgy sounds. Their circulation is quite restricted.

A dye study in Barnegat Bay by Carpenter (1965)(9) indicated a residence time of roughly five days, a tidal excursion of about one mile, and typical bay water velocities of several tenths of a knot. Federal Water Pollution Control Administration drogue studies made in 1966 indicated elliptical particle trajectories over a tidal cycle and appeared to confirm Carpenter's conservative speed and excursion values. The tide provides most of the energy for circulation, although water from Toms River contributes to a general southerly drift.

As a result of this limited circulation, residence time of pollutants in many of the bays and inlets is increased, which results in further degradation of water quality.

III. WATER USES

Water Supply

An inventory of municipal and institutional water supplies in the three county study area was conducted in 1966. The results, shown in Table 2, indicate significant seasonal variation in demand. There are 51 systems supplying 28 MGD in the winter months, while demand in the summer increases to 76 MGD. The majority of the systems are small in size. Only nine systems supply 1.0 MGD or more during the winter months.

All of these systems rely on ground water sources, although Atlantic City utilizes a supplemental surface water source during period of peak demand.

Industry is generally supplied by the systems described above, and according to one estimate, utilizes about 5 MGD of the total municipal supply. (10) The only major self-supplied industry in the study area is Toms River Chemical Co., which utilizes 3 to 4 MGD of ground water for process purposes, and an additional 13 MGD of Toms River water for cooling.

Recreational Bathing

Recreational bathing, most of which is along the Ocean, represents an important water use and economic factor in the New Jersey Coastal area. Table 3 presents data on the number of visitors at each of the 31 public bathing areas in the three counties for 1964. Use amounted to 42,000,000 visitor-days, evenly distributed throughout the three counties. These figures are for public beaches only, and do not include the extensive use of private beaches where no records are maintained.

The Federal Ad Hoc Water Resources Council has suggested that a minimum value of $.50 per visitor-day provides a reasonable estimate of the economic value of this industry. Using this guideline, recreational bathing has a minimum value of nearly $21,000,000 annually in the study area. This figure, however, is a minimum and does not represent the full economic benefit associated with recreational bathing in this region. As a resort area, much of the region's economy derives from activities associated with forms of recreation, such as bathing. In 1962, for example, it is estimated that wages paid to employees of hotels, motels, eating and drinking establishments in the three county area amounted to nearly $24,000,000.

TABLE 2

MUNICIPAL & INSTITUTIONAL WATER SUPPLY SYSTEMS
WATER CONSUMPTION - N. J. COASTAL BASIN

A. ATLANTIC COUNTY

Facility	Consumption - mgd Winter	Summer
1. Atlantic City Mun.	10.0	20.0
2. Atlantic County W. Co.	1.80	5.60
3. Brigantine Mun.	0.51	1.13
4. Egg Harbor City Mun.	0.35	0.50
5. Hamilton Twp. Mun.	0.25	0.25
6. Hammonton Mun.	0.90	2.00
7. Longport Mun.	0.25	0.80
8. Margate Mun.	1.00	2.00
9. Atlantic County Hosp.	0.04	0.09
10. Ventnor Mun.	1.07	2.35
TOTAL ATLANTIC COUNTY	16.17	34.72

B. CAPE MAY COUNTY

Facility	Consumption - mgd Winter	Summer
1. Avalon Mun.	0.15	1.20
2. Cape May Mun.	0.70	2.10
3. Lower Twp. W. Co.	-	-
4. Crest Haven Home	0.01	0.01
5. Neptunnus W. Co.	0.18	0.18
6. Ocean City W. Co.	1.00	5.20
7. Sea Isle City Mun.	0.25	1.00
8. Stone Harbor Mun.	0.45	0.85
9. Corson's Inlet W. Co.	0.08	0.12
10. Wildwood Mun.	1.00	7.40
11. N. J. Colony @ Woodbine	0.20	0.20
12. Woodbine W. Co.	0.30	0.90
TOTAL CAPE MAY COUNTY	4.32	19.16

TABLE 2 (CONT'D.)

MUNICIPAL & INSTITUTIONAL WATER SUPPLY SYSTEMS
WATER CONSUMPTION - N. J. COASTAL BASIN

C. OCEAN COUNTY

	Facility	Consumption - mgd Winter	Summer
1.	Barnegat Light Mun.	0.08	0.35
2.	Bay Head Mun.	0.40	1.65
3.	Beachwood Mun.	0.10	0.18
4.	Beach Haven Mun.	0.20	1.00
5.	Arlington Beach W. Co.	0.04	0.12
6.	Bayville W. Co.	0.03	0.03
7.	Shore W. Co.	0.06	0.16
8.	Toms River W. Co.	1.90	1.90
9.	Harvey Cedars Mun.	0.06	0.31
10.	Island Hgts Mun.	0.18	0.30
11.	Jackson Twp. Mun.	0.60	0.70
12.	Lakehurst Mun.	0.12	0.30
13.	Lakewood W. Co.	1.00	1.20
14.	S. Lakewood W. Co.	0.03	0.14
15.	Lavallette Mun.	0.15	0.80
16.	Mystic Isles W. Co.	0.08	0.45
17.	Long Beach W. Co.	0.25	1.50
18.	Long Beach Twp. Mun.	0.05	0.15
19.	Cedar Glen City	0.10	0.10
20.	Ocean Gate Mun.	0.09	0.30
21.	Pine Beach Mun.	0.10	0.10
22.	Pt. Pleasant Mun.	1.50	2.50
23.	Pt. Pleasant Beach Mun.	0.60	2.00
24.	Seaside Hgts. Mun.	0.30	2.89
25.	Seaside Park Mun.	0.10	1.62
26.	Ship Bottom Mun.	0.20	0.79
27.	Stafford W. Co.	0.10	0.28
28.	Surf City Mun.	0.10	0.67
29.	Tuckerton W. Co.	0.04	0.50
	TOTAL OCEAN COUNTY	8.56	22.99
	TOTAL 3 COUNTIES	29.05	76.87

TABLE 3

ESTIMATED BEACH USE AND INCOME, 1964
FOR SELECTED RESORT CENTERS IN THE STUDY AREA

Resort Centers and Municipalities by County	Estimated Population Normal (Resident)	Summer	Beach Use Weekdays	Weekends	Total a/ Beach Use
Atlantic County					
Atlantic City	60,400	210,000	110,000	150,000	12,122,300 b/
Brigantine City	4,590	15,000	1,500	3,000	165,000
Long Port Borough	1,060	8,000	600	1,500	73,500
Margate City	10,000	30,000	5,000	12,000	600,000
Ventnor City	8,900	20,000	7,000	20,000	920,000
Total	84,950	283,000	124,100	186,500	13,880,800
Cape May County					
Avalon Borough	810	16,000	8,000	12,000	780,000
Cape May City	4,600	25,000	15,000	28,000	1,600,000
Cape May Point Borough	280	2,300	750	1,800	90,000
Lower Township	7,110	20,000	318	650	35,330
North Wildwood City	3,670	48,000	35,000	40,000	2,500,000
Ocean City	7,730	150,000	25,000	40,000	2,500,000
Stone Harbor Borough	860	25,000	10,000	15,000	975,000
Sea Isle City	1,380	22,000	10,000	18,000	1,050,000
Upper Township	2,690	4,000	1,500	3,500	177,500
Wildwood City	4,680	125,000	45,000	75,000	4,575,000
Wildwood Crest Borough	3,270	20,000	17,600	23,100	1,633,500
Total	37,080	457,300	168,168	257,050	15,916,330
Ocean County					
Barnegat Light Borough	320	10,000	4,000	7,000	415,000
Bay Head Borough	820	5,000	2,500	4,000	250,000
Beach Haven Borough	1,060	22,000	2,000	5,000	245,000
Berkeley Township	5,240	10,000	100	500	18,500
Brick Township	20,830	65,000	1,000	2,500	122,500
Dover Township	22,070	35,000	1,500	3,000	165,000
Harvey Cedars	140	5,500	2,750	3,500	252,500

TABLE 3 (CONT'D.)

ESTIMATED BEACH USE AND INCOME, 1964
FOR SELECTED RESORT CENTERS IN THE STUDY AREA

Resort Centers and Municipalities by County	Estimated Population Normal (Resident)	Summer	Beach Use Weekdays	Weekends	Total a/ Beach Use
Lavallette Borough	840	25,000	9,000	12,000	840,000
Long Beach Township (all four parts)	1,770	35,000 c/	20,000	25,000	1,945,000 c/
Mantoloking Borough	180	1,600	400	500	36,500
Pt. Pleasant Beach Borough	4,140	35,000	20,000	25,000	1,945,000
Seaside Heights Borough	970	33,000	12,800	27,500	1,455,500
Seaside Park Borough	1,060	25,000	18,591	37,182	1,577,960
Ship Bottom Borough	750	16,000	22,800	32,600	2,183,000
Surf City Borough	450	13,000	5,000	8,000	665,000
Total	60,640	336,100	122,441	193,282	12,116,460
Grand Total	182,670	1,076,400	414,709	636,832	41,913,590

a/ Total beach use was arrived at by multiplying the "Beach Use Weekdays" figure by 60 and the "Beach Use Weekend days" by 25, a period encompassing 85 days from June 15 to September 7, 1964. An estimation method developed by the New Jersey State Navigation Bureau.

b/ Total beach use for Atlantic City was compiled for the period from June 1 through September 30.

c/ No Beach Use Report - Estimate based on Long Beach Center, with like summer population.

Source: New Jersey State Navigation Bureau

Recreational Boating

Boating is another important factor in the economy of the New Jersey coastal area. From Manasquan River to Cape May there are 260 known marinas or dock facilities for recreational boating. (11) Two-thirds of these are located north of Great Bay.

One of the attractions of the Atlantic coastal counties to the boating enthusiast is the New Jersey Intracoastal Waterway. Small craft (draft four feet or less) can cruise protected waters from Manasquan Inlet to Cape May Inlet and then proceed by canal to Delaware Bay and the national Intracoastal Waterway.

In 1965, New Jersey issued 122,000 motor boat licenses. In addition, there are 200,000 boats in the New York City-Long Island area, many of which cruise the New Jersey Intracoastal Waterway. (12)

Commercial Finfishing

Commercial finfishing is an important industry in New Jersey, although the catch value has declined over the past decades. The 1965 catch, with a value of $4.7 million, was less than half that of 1956. (13) The relative importance of finfishing to the total New Jersey fish catch (finfish plus shellfish) has also sustained a similar downward trend, from 62 percent of the total take in 1956 to about 40 percent in 1965. In comparison, the United States total harvest of finfish has remained relatively unchanged for the last ten years, with an annual value of $200 million.

Although the finfishing industry in New Jersey as a whole has slumped sharply, the three-county study area reported an advance of 57 percent, during the same period, from $2 million in 1956 to $3.1 million in 1965. In terms of relative share of the State's total catch, the area now accounts for two-thirds of the total finfish harvest as compared with one-fifth ten years earlier.

Commercial Shellfishing

The New Jersey shellfish industry services a significant portion of the Northeast market. In 1956, the study area accounted for 40 percent of the New Jersey shellfish output, which had a total landing value of $5.7 million. (14) In 1965, this same area contributed 85 percent of the State's total shellfish catch valued at $6.5 million. This increased contribution by the study area to the State's total shellfish take is due to the increasing harvest of the surf clam, a mollusk found in moderately deep ocean waters. The value of the surf clam harvest in the study area rose nearly 150 percent in nine years, from $1.2 million in 1956 to $3.0 million in 1965, with all of the gain taking place off Ocean County.

In contrast to the accelerated demand for the surf clam, the landing value of hard clams, soft clams and oysters in New Jersey declined from $3.7 million in 1956 to $1.6 million in 1965. Expressed in relative shares of the industry, the value of the hard clam, soft clam and oyster harvest fell from 64 percent of the total shellfish output in 1956 to less than 24 percent of the total in 1965.

Hence, although the New Jersey shellfish industry has shown a moderate gain of 14 percent in value of output in the period selected for study (1956-1965) the direct market harvest of hard and soft clams and oysters has declined, due primarily to pollution in the case of clams and to natural disease in the case of oysters.

IV. SOURCES OF POLLUTION

The New Jersey coastal waters serve as a receiving body for the discharge of wastes from municipalities, institutions, industry, individual cesspools and septic tanks, recreational boating; and to a lesser degree, surface runoff and agricultural land drainage.

Municipal and Institutional Wastes

Municipal and institutional waste discharges constitute the greatest source of pollution within the New Jersey coastal basin. Many of these sewage systems are subjected to large seasonal load variations, which are due to an increase in the resident and transient population during the summer recreational period. As a result, a number of water pollution control plants are overloaded or operate at capacity during the summer.

A recent Federal Water Pollution Control Administration survey of municipal and institutional wastes discharged into the New Jersey Coastal Basin between Shark River and Cape May found that: 23 sources discharge directly into the Atlantic Ocean, 30 discharge directly into the estuary (shellfish waters), 23, including three Federal installations, discharge to tributary streams.

Table 4 summarizes the information regarding these waste sources. Those sources discharging directly to the Ocean or to the estuary (shellfish waters) are shown on Fig. 1. In Table 4 waste loads have been estimated for 5 day 20° Centigrade biochemical oxygen demand (BOD) in pounds per day, based upon summer population, a factor of 0.2 pounds of BOD per capita, and a percentage of BOD removal for each sewage treatment plant. Basically, plants were credited with 35 percent BOD removal for primary treatment, 70 percent for intermediate treatment and 85 percent for secondary treatment.* The percentage of BOD removal was then adjusted in those cases where plants were found to be overloaded. Chlorination facilities are provided for all of the systems shown in Table 4. Of the 76 municipal type systems listed, 39 serving 1,041,000 persons provide primary treatment or less, 20 serving 66,900 persons provide intermediate treatment and 17 serving 118,000 persons provide secondary treatment.

*For purposes of this study, the type of treatment provided is defined as follows:

Primary - primary settling
Intermediate - primary settling plus biological treatment
Secondary - primary settling, biological treatment and secondary settling.

TABLE 4

MUNICIPAL WASTE DISCHARGES - NEW JERSEY COASTAL BASIN

(SHARK RIVER TO CAPE MAY)

Municipality	Rec. Waters	Est. Pop. (summer)	Degree of Treatment	FLOW-MGD		ESTIMATED BOD LOADINGS, lbs/day		
				Design	Actual Summer	Influent	Percent Removal	Effluent
Systems Discharging Directly to Atlantic Ocean								
1. Neptune Twp. #1	Atlantic Ocean	20,000[a]	Primary	1.16	2.50	4,000	20	3,200
2. Bradley Beach #1	Atlantic Ocean	20,000	Primary	0.65	0.15	6,000	35	3,900
3. Bradley Beach #2	Atlantic Ocean	10,000	Primary	0.50	0.08	6,000	35	3,900
4. Neptune City	Atlantic Ocean	3,000	Primary	0.31	0.30	600	35	390
5. Neptune Twp. #2	Atlantic Ocean	2,000[a]	Secondary	2.50	0.20	400	85	60
6. Avon-By-The-Sea	Atlantic Ocean	12,000	Primary	1.00	0.27	2,400	35	1,560
7. Belmar & S. Belmar	Atlantic Ocean	30,000	Primary	2.50	1.20	6,000	35	3,900
8. Spring Lake Hgts.	Atlantic Ocean	8,000	Primary	3.50	0.22	1,600	35	1,040
9. Spring Lake Boro.	Atlantic Ocean	12,000	Primary	1.50	0.65	2,400	35	1,560
10. Spring Lake Boro. #2	Atlantic Ocean	700	Primary	.14	Unk	140	35	90
11. Sea Girt	Atlantic Ocean	3,000	Primary	0.50	.23	600	35	390
12. Manasquan	Atlantic Ocean	18,000	Primary	1.00	0.27	3,600	35	2,350
13. Pt. Pleasant Beach	Atlantic Ocean	15,000	Primary	1.50	0.82	3,000	35	1,950

a/ Total population of township is 25,000, each plant will serve approx. ½ of the population. As of this report not all are tied-in to sewer-No estimate given.

TABLE 4 (CONT'D.)

MUNICIPAL WASTE DISCHARGES - NEW JERSEY COASTAL BASIN

(SHARK RIVER TO CAPE MAY)

Municipality	Rec. Waters	Est. Pop. (summer)	Degree of Treatment	FLOW-MGD		ESTIMATED BOD LOADINGS, lbs/day		
				Design	Actual Summer	Influent	Percent Removal	Effluent
Systems Discharging Directly to Atlantic Ocean								
14. Bay Head	Atlantic Ocean	6,000	Primary	0.50	0.35	1,200	35	780
15. Lavallette	Atlantic Ocean	5,000	Primary	0.87	0.80	1,000	35	650
16. Dover Twp. Ortley Bch.	Atlantic Ocean	7,000	Primary	2.55	1.10	2,500[b]	54	1,150[b]
17. Seaside Hgts.	Atlantic Ocean	50,000	Primary	1.70	1.50	10,000	35	6,500
18. Seaside Park	Atlantic Ocean	175,000[c]	Primary	0.96	1.34	7,000	20	5,600
Berkeley Twp. Sewer Auth.								
19. (S. Seaside Park)	Atlantic Ocean	500	Intermed.	0.44	0.05	100	70	30
20. Surf City	Atlantic Ocean	15,000	Primary	0.72	0.40	8,000	35	1,950
21. Ship Bottom	Atlantic Ocean	20,000	Primary	1.20	0.40	4,000	35	2,600
22. Long Beach Twp.	Atlantic Ocean	50,000	Primary	2.00	1.30	10,000	35	6,500
23. Beach Haven	Atlantic Ocean	15,000	Primary	0.60	0.93	3,000	20	2,400
Systems Discharging Directly to Shellfishing Waters								
24. Brigantine	Absecon Inlet	25,000	Intermed.	1.00	3.50	4,800	50	2,400

b/ Plant Data

c/ Summer population of 175,000 obtained from utility is probably too high. May be a peak weekend figure-not reflected in average summer flow. Population of 35,000 used in calculation of BOD loading.

TABLE 4 (CONT'D.)

MUNICIPAL WASTE DISCHARGES - NEW JERSEY COASTAL BASIN

(SHARK RIVER TO CAPE MAY)

Municipality	Rec. Waters	Est.Pop. (summer)	Degree of Treatment	FLOW-MGD		ESTIMATED BOD LOADINGS, lbs/day		
				Design	Actual Summer	Influent	Percent Removal	Effluent
Systems Discharging Directly to Shellfishing Waters								
25. Atlantic City (City Island Plant)	Beach Thorofare	250,000	Primary	18.00	16.00	50,000	35	32,000
26. Atlantic City (Texas Ave. Plant)	Beach Thorofare	12,000	Screening & Cl_2	Unk	0.75	2,400	10	2,150
27. Pleasantville	Lakes Bay	25,000	Secondary	2.00	1.30	5,000	85	750
28. Ventnor - Margate	Beach Thorofare	55,000	Primary	3.50	8.00	11,000	20	8,800
29. Longport	Beach Thorofare	6,500	Primary	0.50	0.60	1,300	30	910
30. Sommers Point	Patcong Creek	7,000	Secondary	1.00	0.50	1,400	85	210
31. Ocean City (3rd Ave. Plant)	Great Egg Harbor	100,000	Primary	3.60	3.40	20,000	30	14,000
32. Ocean City (46th Ave. Plant)	Great Egg Harbor	25,000	Secondary	1.00	0.50	5,000	85	750
33. Sea Isle City	Ludhams Thorofare	3,500	Primary	0.35	0.35	700	30	490
34. Avalon Sew. Auth.	Great Sound	10,000	Intermed.	1.00	0.80	2,000	70	600
35. Stone Harbor Boro	Great Channel	10,000	Primary	1.20	0.85	2,000	35	1,300
36. North Wildwood City	Hereford Inlet	30,000	Primary	2.00	1.50	7,000	35	4,550
37. Wildwood City	Post Creek Basin	50,000	Primary	4.00	5.00	10,000	30	7,000

TABLE 4 (CONT'D.)

MUNICIPAL WASTE DISCHARGES - NEW JERSEY COASTAL BASIN

(SHARK RIVER TO CAPE MAY)

Municipality	Rec. Waters	Est. Pop. (summer)	Degree of Treatment	FLOW-MGD		ESTIMATED BOD LOADINGS, lbs/day		
				Design	Actual Summer	Influent	Percent Removal	Effluent
Systems Discharging Directly to Shellfishing Waters								
38. Wildwood Crest	Grassy Sound	17,000	Primary	1.90	1.50	3,400	30	2,380
39. Brisbane Child Cent. (Allaire)	Drisbane Lk. Manasquan R.	200	Primary	Unk	.016	40	35	25
40. Dover Sewer Auth. Toms R. Plant	Toms R.	4,000	Primary	.35	.48	800	35	520
41. Island Hgts. Boro	Dollan's Cr. Toms R.	3,700	Secondary	.40	.14	740	85	110
42. Berkeley Twp. Mun. (Clamming Creek)	Clamming Cr. (Barnegat Bay)	500	Intermed.	.27	.07	100	70	30
43. Tuckerton Mun.	Tuckerton Cr. (Little Egg Harbor)	7,000	Intermed.	.50	.24	1,400	70	420
44. Little Egg Harbor Twp. (Mystic I. Sewer Co.)	Big Creek (Great Bay)	7,000	Intermed.	.50	.24	1,400	70	420
45. Wall Twp. N. J. Highway Auth.	Shark R.	2,000	Secondary	.03	.02	400	85	60
46. Wall Twp. Allenwood Hosp.	Manasquan R.	200	Intermed.	.04	.02	40	70	12
47. Dover Twp.-Bd. of Ed.	Barnegat Bay	NA	Intermed.	.04	NA	NA	NA	NA
48. Lacey Twp. N. J. Highway Auth.	Forked R.	200	Secondary	.04	.02	40	85	6

TABLE 4 (CONT'D.)

MUNICIPAL WASTE DISCHARGES - NEW JERSEY COASTAL BASIN

(SHARK RIVER TO CAPE MAY)

Municipality	Rec. Waters	Est. Pop. (summer)	Degree of Treatment	FLOW-MGD Design	FLOW-MGD Actual Summer	ESTIMATED BOD LOADINGS, lbs/day Influent	Percent Removal	Effluent
Systems Discharging Directly to Shellfishing Waters								
49. Lacey Twp. Forked R. Marina	Forked R.	NA	Primary	.006	NA	NA	NA	NA
50. Longport 14th St.	Risley Channel	NA	Primary	.04	NA	NA	NA	NA
51. Dennis Twp. N. J. Highway Auth.	Ludhams Bay	2,000	Secondary	.03	.02	400	85	60
52. Cape May C. H. Middle Twp. S. A.	Hereford In.	4,600	Primary	.10	NA	920	30	550
53. Garden Lake Middle Twp.	Grassy Sd.	NA	Intermed.	.02	NA	NA	NA	NA
Systems Discharging Indirectly to Shellfishing Waters								
54. Camp Evans	Shark River	300	Primary[d/]	0.56	0.03	100[b/]	85	15[b/]
55. Freehold Boro	Debois Creek Manasquan River	10,000	Secondary	0.80	0.65	2,000[b/]	85	300[b/]
56. Freehold Twp. (Freehold Sewer Co.)	Trib. to Manasquan River	1,100	Intermed.	0.30	0.20	220	75	50
57. Freehold Twp. (Wynnewood Sewage Co.)	Manasquan River-Passaquanoca Bk.	1,000	Intermed.	0.24	0.12	325[b/]	70	95[b/]

b/ Plant Data.
d/ Plant has secondary facilities - Due to low flows, only primary units in use.

TABLE 4 (CONT'D.)

MUNICIPAL WASTE DISCHARGES - NEW JERSEY COASTAL BASIN

(SHARK RIVER TO CAPE MAY)

Municipality	Rec. Waters	Est. Pop. (summer)	Degree of Treatment	FLOW-MGD		ESTIMATED BOD LOADINGS, lbs/day		
				Design	Actual Summer	Influent	Percent Removal	Effluent
Systems Discharging Indirectly to Shellfishing Waters								
58. So. Freehold Regional H. S.	Manasquan River	300	Intermed.	0.06	0.01	60	70	20
59. Jackson Twp. Mun. (Brookwood #3)	N. Branch-Metedeconk R.	1,200	Intermed.	0.30	0.12	375[b/]	87	50[b/]
60. Jackson Twp.Mun. (Brookwood #1)	N. Branch-Metedeconk R.	2,000	Intermed.	0.15	0.20	670[b/]	75	165[b/]
61. Howell Twp. (Maxim Sewer Co.)	Haystack Ck. N. Br. Metedeconk	4,000	Intermed.	0.45	0.20	670[b/]	88	85[b/]
62. Lakewood Boro (Lakewood Water Co.)	S. Branch Metedeconk R.	12,500	Secondary	1.90	2.00	13,000[b/,e/]	90	1,300[b/]
63. Jackson Twp. Mun. (Brookwood #2)	S. Branch Metedeconk R.	1,000	Intermed.	0.15	0.10	290[b/]	86	42[b/]
64. Jackson Twp. (Harmony Sewer Co.)	S. Branch Metedeconk R.	680	Intermed.	0.14	0.50	210[b/]	95	10[b/]
65. Lakewood (Leisure Village)	Kettle Cr.-Barnegat Bay	700	Intermed.	0.30	0.03	390[b/]	86	54[b/]
66. Lakehurst Mun.	Manapaque-S. Br. Toms R.	1,500	Secondary	0.50	0.12	300	85	45
67. Lakehurst Naval Air Station	Ridgeway Br.-Toms River	3,000	Primary	0.50	0.20	600	35	390

b/ Plant Data.
e/ Includes industrial wastes.

TABLE 4 (CONT'D.)

MUNICIPAL WASTE DISCHARGES - NEW JERSEY COASTAL BASIN

(SHARK RIVER TO CAPE MAY)

Municipality	Rec. Waters	Est. Pop. (summer)	Degree of Treatment	FLOW-MGD		ESTIMATED BOD LOADINGS, lbs/day		
				Design	Actual Summer	Influent	Percent Removal	Effluent
Systems Discharging Indirectly to Shellfishing Waters								
68. Stafford Twp. Mun.	Mill Cr.- (Manahawkin)	7,000	Secondary	0.49	0.28	1,400	85	210
69. Winslow Twp. (State Hosp. @ Ancora)	Blue Anchor Bl. (Mullica River)	2,500	Secondary	1.20	0.24	500	85	75
70. Hammonton Mun.	Hammonton Cr.- (Mullica River)	6,000	Secondary	1.20	0.70	2,400 b/	94	140 b/
71. Egg Harbor City	Gloucester Cr.- (Mullica River)	4,500	Secondary	1.00	0.30	690 b/	93	50 b/
72. Berlin Boro Mun.	Tinkers Bk.- (G. Egg Harbor R.)	3,000	Intermed.	0.660	0.25	720 b/	85	110 b/
73. Monroe Mun. Util. Auth. (Williamstown)	Trib. to G. Egg Harbor R.	4,600	Secondary	0.450	0.35	920	85	140
74. Weymouth Twp. Mun. (Belcoville Sect.)	S. Branch (G. Egg Harbor R.)	350	Primary	0.60	0.030	70	35	45
75. Mays Landing (Oakcrest School)	Gravelly Run (G. Egg Harbor R.)	1,780	Intermed.	0.030	0.011 f/	356	70	110
76. Pomona (FAA - NAFEC)	G. Egg Harbor R.	2,000	Secondary	0.21	0.15	400	85	60

b/ Plant Data.
f/ Day School - Flow figure represents winter or school period.

The BOD loadings discharged by these systems are summarized in Table 5. Of the total load of more than 136,000 pounds of BOD per day, nearly 60 percent is discharged to the shellfish waters. Less than three percent of the load is imposed upon the tributary waters.

TABLE 5

MUNICIPAL WASTE LOADINGS TO STUDY AREA

Receiving Water	No. of Plants	Est. Summer Pop. Served	Est. Pounds BOD/day
Atlantic Ocean	23	497,200	52,450
Estuary (Shellfish Waters)	30	657,400	80,500
Tributaries	23	71,000	3,560
Totals	76	1,225,600	136,510

The majority of the waste load to the estuarine shellfish waters is concentrated in the Atlantic City and the Wildwood-Cape May areas. Near Atlantic City there is both an intense concentration of recreational facilities, and three plants which operate beyond design capacity. About 80 percent of the population in this area is served only by primary treatment. In the Wildwood-Cape May area, of the six municipal sewage treatment plants which discharge about 10 mgd directly into the Intracoastal Waterway, five provide primary treatment and one provides intermediate treatment.

Thirty-five percent of the waste load to the tributary waters emanates from one plant, Lakewood Boro, which discharges to the South Branch of the Metedeconk River. The influent to this secondary plant amounts to 13,000 pounds of BOD per day of which an estimated 10,000 pounds is attributable to industrial waste.

The 23 municipal plants which discharge directly into the Atlantic Ocean utilize outfall pipes extending from 1,000 to 1,200 feet offshore. For the most part, the effluent from plants discharging municipal waste directly into the ocean is chlorinated only from May to October each year.

Industrial Wastes

The discharge of industrial wastes within the New Jersey coastal basin does not appear to be a significant problem at present. The study area is essentially agricultural and recreational by nature, with only light industry. The one exception is the Toms River Chemical Corp., which employs about 1200 persons. This plant, which produces dyes, resins

and plastics, provides treatment for combined industrial wastes and sanitary sewage and discharges the effluent by means of pipeline into the Atlantic Ocean. It is understood that the effluent is not chlorinated since chlorine reacts with the industrial waste to produce toxic compounds.

A review of industrial directories showed a total of 26 other industries which by virtue of their location and general process description, might contribute waste to the shellfish waters. On further investigation, it was found that 13 of these plants discharged all wastes to municipal sewage treatment facilities and the remainder utilized dry processes which would not result in liquid wastes.

Cesspools and Septic Tanks

Based upon Bureau of Census data for 1960, within the Atlantic Coastal watershed of New Jersey there are more than 300,000 persons in 100,000 homes who dispose of domestic sanitary waste waters by individual cesspools or septic tanks. Leaching of pollutants, in particular nutrients, from inadequate cesspools and septic tanks may constitute a significant source of pollution of these waters.

Recreational Boating

Recreational boating can represent a significant source of pollution particularly from the standpoint of pathogenic bacteria. Over 300,000 boats are registered within a few hours drive of th study area, which indicates that wastes from this source may be highly significant. The State of New Jersey does not at present have any regulations governing the discharge of human waste from boats in tidal waters.

Other Sources of Pollution

Water quality may be adversely affected by a variety of other land and water uses. Agricultural activities within the study area result in agricultural chemicals spread over the land surface being washed into surface waters or percolated into the ground water aquifers. This transport of nutrient fertilizers and toxic herbicides and pesticides, across and through the land into adjacent bodies of water, should be recognized as a possible contributing factor to the problems in the waters of the study area.

The disturbance of bottom muds by dredging operations can result in a re-suspension of accumulated organic sludges and silt. In addition, uncontrolled dredging may result in the formation of significant potholes in the bottom of bays, thereby increasing the detention time and reducing the circulation, the result being inadequate mixing of pollutants with the receiving water and inadequate flushing of the system.

V. EFFECTS OF WASTE ON WATER QUALITY AND USES

One of the problems of waste contamination of the water of the bays and inlets in the New Jersey Coastal area can be illustrated by a statement issued by the President's Science Advisory Committee on Barnegat Bay, an area typical of the New Jersey coast. This report states in part:

"1. Barnegat Bay, N. J.: Sewage - Proliferation of a sudden Red-Tide in Barnegat Bay during August, 1964 generated considerable controversy which centered on the role of a small chemical company whose effluents enter the bay via a tidal estuary. Barnegat Bay.....is shallow, highly productive, and its northern shores are densely populated with many miles of small summer cottages in rows of 10-20 perpendicular to the bay.

"...Most bay residents assumed that the bloom water discoloration and fish kill were due to the chemical company's dye effluent, although actually the bloom species does not utilize this kind of molecule. Organic nitrate and phosphate sources and bacteria...which most probably caused their massive proliferation are the result of sewage and septic tank wastes--wastes from cottages of persons who populated Barnegat's shores to enjoy their recreational resources...

"...Thus, knowledge of the nutritional requirements of the bloom species gives circumstantial evidence that the source of pollution which supported the red tide was primarily sewage that had leached into the bay. A repetition of this occurrence in coming summers will undoubtedly damage the shore resort economy of several towns along Barnegat's banks."(14)

Bacteria

Human fecal bacteria constitute a major water pollution problem in the study area. These bacteria originate from the discharge of inadequately treated municipal wastes, from the discharges of inadequate septic tanks and cesspools on or near the shore, and from recreational boats using these waters.

The chain of disease transmission by pathogenic bacteria from human waste, through shellfish which are eaten raw or improperly cooked, has been well established. In an attempt to control such disease transmission, the National Shellfish Sanitation Program was established. This is an unusual teaming of state, federal and industry resources aimed at preserving and managing the shellfish industry. The National Program, of which New Jersey is a member, has adopted guides for the determination of proper sanitary quality and classification for the designation of waters approved for shellfish harvesting. Approval or condemnation of a shellfish area is based

on the following factors: (15)

1. Amount of dilution water available;
2. Hydrographic conditions;
3. Survey of actual and potential sources of pollution, including fecal material, radionuclides, and chemical wastes;
4. Possible fresh pollution sources, such as that from toilet discharges from boats directly over shellfish beds;
5. Lack of knowledge of above factors pending a sanitary survey; and
6. Bacteriological data, with samples collected under the worst hydrographic conditions.

In accordance with this program the New Jersey State Department of Health has closed valuable shellfish harvest areas throughout the study area. The active shellfish areas which have been closed are shown in Figure I and listed in Table 6. A copy of the closure orders is included in the Appendix. The harvest of shellfish is prohibited year round in more than 21,000 of the 115,400 acres of water within the study area.

TABLE 6

ACTIVE SHELLFISH AREAS CLOSED TO HARVESTING OF SHELLFISH*
(AS OF 1965)

Area	Acres	Location
Areas closed full year:		
Shark River	600	South of Asbury Park, N. J.
Manasquan River	880	Point Pleasant, N. J.
Barnegat Bay	1,950	Forked River south to Manahawkin Causeway
Forked River	140	South of Toms River
Oyster Creek	90	South of Forked River
Little Egg Harbor	1,670	South of Barnegat Bay
West Creek	50	North of Tuckerton, N. J.
Cedar Run	2	North of West Creek
Tuckerton Cove	20	Tuckerton, N. J.
Tuckerton Creek	10	Tuckerton, N. J.
Big Thorofare and Big Creek	10	North of Great Bay
Bass River	75	New Gretna, N. J.
Nacote Creek	5	Tributary of Mullica River
Mott Creek	3	Great Bay

*Data from the National Shellfish Sanitation Program as of 1965. Currently being revised to reflect changes since that date.

TABLE 6 (CONT'D.)
ACTIVE SHELLFISH AREAS CLOSED TO HARVESTING OF SHELLFISH
(AS OF 1965)

Area	Acres	Location
Oyster Creek	1	Great Bay
Bonita Tideway	300	West Shore of Brigantine, N.J.
Reed Bay	130	West of Brigantine, N. J.
Absecon Bay	1,740	West of Atlantic City, N. J.
Absecon Channel	1,000	East of Absecon Channel
Beach Thorofare	1,340	Atlantic City to Ocean City
Great Thorofare	200	Atlantic City, N. J.
Inside Thorofare	130	Atlantic City, N. J.
Lakes Bay	1,940	Atlantic City, N. J.
Risley Channel	290	Margate City, N. J.
Scull Bay	640	West of Margate City, N. J.
Broad Channel	210	South of Scull Bay
Great Egg Harbor Inlet	860	Ocean City, N. J.
Great Egg Harbor Bay	950	West of Ocean City, N. J.
Patcong Creek	150	West of Ocean City, N. J.
Great Egg Harbor R.	540	West of Ocean City, N. J.
Tuckahoe River	170	West of Ocean City, N. J.
Crooked Horn Creek	150	South of Peck Bay
Beach Creek	2	North of Strathmere, N. J.
Ludlam Bay	50	South of Strathmere, N. J.
Ludlam Thorofare and Sunk Creek	150	South of Strathmere, N. J.
South Channel	70	West of Avalon, N. J.
Ingram Thorofare	250	West of Avalon, N. J.
Waters of Avalon Vicinity	5	West of Avalon, N. J.
Gull Island Thorofare	280	West of Stone Harbor, N. J.
Cresse Thorofare	150	West of Stone Harbor, N. J.
Great Channel	690	Stone Harbor, N. J.
Hereford Inlet	540	N. Wildwood, N. J.
Grassy Sound Channel	350	N. Wildwood to Wildwood Crest
Beach Creek	110	N. Wildwood, N. J.
Cresse Creek	110	N. Wildwood, N. J.
Grassy Sound	720	N. Wildwood, N. J.
Richardson Sound	530	West of Wildwood, N. J.
Sunset Lake	230	Wildwood Crest, N. J.
Swain Channel	50	West of Sunset Lake
Taylor Sound	90	West of Swain Channel
Jarvis Sound	390	South of Wildwood Crest, N. J.
Cape May Inlet	200	North of Cape May, N. J.
Cape May Harbor	360	North of Cape May, N. J.
Total, Full year closure	21,573	Acres of Active Shellfish Production Areas closed full year due to pollution.

TABLE 6 (CONT'D.)
ACTIVE SHELLFISH AREAS CLOSED TO HARVESTING OF SHELLFISH
(AS OF 1965)

Areas closed part of year; Conditionally approved at other times:

Area	Acres	Location
Little Egg Harbor	170	South of Barnegat Bay
Tuckerton Cove	140	Tuckerton, N. J.
Beach Thorofare	70	Ocean City, N. J.
Jenkins Sound	150	North of Wildwood, N. J.
Total, Seasonal closure	530	Acres of Active Shellfish Production Areas closed part of the year.

The compilation of actual and potential harvest of hard and soft clams in the three county coastal areas indicates that a minimum of 2½ bushels per acre would be harvested in the acreage (21,573) closed year-round to shellfishing if existing and potential pollution sources were abated and the harvest (catch) is left to purely natural propagation. This potential natural harvest from the area now closed would have an economic value of roughly $250,000 per year, based on an ex-vessel price of $4.61 per bushel for the study area in 1965. Clammers could double the natural harvest to 5 bushels per acre by carrying out only the simplest of controlled fish farm practices. Accordingly, using simple farm practices the value would double, yielding clammers in the study area an output valued at $500,000 per year.

If the New Jersey shellfish industry carried on a scientific program to maximize the output of hard and soft clams it would be possible to obtain an annual harvest of 50 bushels per acre, (16) which when applied to the polluted shellfish acreage enumerated in the study would have an economic value to the clammers of $5,000,000 per year.

A recent study (17) of the Florida shellfish industry and its price structure indicates the total retail value of the shellfish harvest is four times the value at dockside. On this basis, the economic loss to the area as a result of closure of shellfish beds is summarized in Table 7.

TABLE 7

ECONOMIC LOSS TO AREA

Type of Harvest	Annual Loss Dockside	Area
Present (2½ bushel per acre)	$250,000	$1,000,000
Simple Farming (5 bushel per acre)	500,000	2,000,000
Maximum Output (50 bushel per acre)	5,000,000	20,000,000

The economic loss in shellfish production is not the sole damage caused by the discharge of bacteria to the study waters. Bacterial pollution of the study waters, including the tributary streams, creates a hazard to the health of those coming in contact with the waters.

Dissolved Oxygen

Dissolved oxygen is one of the most significant parameters of water quality. When an organic waste, such as that measured by the BOD test, is imposed upon a water, dissolved oxygen is utilized in the stabilization process. Dissolved oxygen is yielded to the water by transfer from the atmosphere and as a result of photosynthetic production by aquatic plants. Adequate levels of dissolved oxygen are necessary to support fish and other aquatic life. When complete depletion of oxygen occurs, the waters become septic and further decomposition produces obnoxious hydrogen sulfide gas, rendering the water unsuitable for any type of activity.

The shellfish waters in the study area receive an estimated 80,500 lbs. per day of BOD from municipal wastes. As a result of the discharge of this waste into waters with limited dilution volume or restricted circulation, such as found in parts of the study area, dissolved oxygen may be depressed to less than desirable values.

Nutrients

Human and animal feces contain phosphorus and nitrogen that serve as nutrients, or fertilizer, for both land and water plant life. Although other elements are necessary as nutrients for plant growth, deficiencies in phosphorus and nitrogen are believed to be the most common limits on aquatic plant growth. Domestic and municipal wastes are the major sources of phosphorus and nitrogen in the study area. Other sources may include the direct discharge from recreational boats, runoff from adjoining agricultural areas, and percolation from cesspools and septic tanks. Current

technology permits the design of treatment plants capable of minimizing the quantity of these elements in the effluent.

The New Jersey Coastal waters are rich in phosphorus and contain adequate nitrogen to support prolific growths of both suspended and attached algae. Whereas open coastal waters commonly contain 0.02 to 0.05 milligrams per liter (mg/l) of phosphorus (as P), the study area waters have been found to contain from 0.10 to 1.45 mg/l of phosphorus. While the limiting concentration of phosphorus for excessive algal growth in sea water has not been established, the commonly accepted limiting concentration in fresh water is 0.01 to 0.015 mg/l.

The limiting value of nitrogen for aquatic plant growths in fresh water is generally accepted to be 0.3 mg/l (as N), whereas the waters of the study area have been found to contain 0.05 - 0.45 mg/l of Ammonia N and 0.05 - 0.43 mg/l of Nitrate N.

With the adequate supply of nitrogen and phosphorus, the waters of the study area support luxurious growths of suspended algae, attached filamentous algae and rooted aquatic plants. The suspended algae generally reduce esthetic enjoyment of the waters by reducing their clarity, sometimes to the extent that objects in more than two feet of water are not visible from the surface.

These algal forms also pose a threat to the dissolved oxygen content of the waters. With changes in environmental conditions, the sudden death and subsequent decomposition of a dense algal population can deplete dissolved oxygen to the extent that fish and other aquatic life are not able to survive.

The attached and filamentous algae and rooted aquatic plants cause another and very obvious type of esthetic damage. They become detached from their moorings, especially during periods of turbulent water, accumulate as slimy masses in the surf and wash up on the shore. It is not uncommon to see masses of these detached plants covering long reaches of the shore several inches deep and many feet from the water's edge. They not only present an unsightly appearance but also decay and produce extremely offensive odors. Such shoreline conditions prevent full development of the recreational potential of the area.

Suspended Solids

Suspended solids include large proportions of decomposable organic solids. Within the study area, the major source of such suspended solids is the discharge of inadequately treated municipal waste. Adequate treatment facilities are capable of removing 90 to 95 percent of such material from municipal wastewaters. Upon discharge to the receiving waters, the

suspended solids immediately impart a disagreeable grey turbidity to the waters and diminish their esthetic appeal. The heavier solids settle to the stream bottom in the vicinity of the points of discharge and form objectionable and harmful sludge deposits. These sludge blankets cover and destroy the bottom aquatic animals that serve as food for fish. A screening survey of the study waters by the Federal Water Pollution Control Administration in 1966 found sludge deposits at 34 sampling stations along the Intracoastal Waterway and its adjoining bays and tributaries. These deposits, in the form of strips of black odorous ooze, were found on the bottom as well as along the shore line, in some cases covered by shallow layers of sand that have been washed over them by wave action.

The organic material in the sludge undergoes a decomposition process which lowers the dissolved oxygen level in the overlying waters, at times to below that needed for fish and other aquatic life to survive. When complete depletion of oxygen occurs, the further decomposition of organic matter produces obnoxious hydrogen sulfide gas which appears as bubbles on the surface. This gas breaks loose masses of the deposited sludge and lifts them to the surface where they appear as unsightly grey or black odorous clumps and rafts.

The lighter suspended solids are carried downstream by the velocity of the flowing water to settle and form similar sludge banks in eddy areas distant from the points of discharge. In coastal streams, the salt content of the sea water precipitates the fine colloidal portions of the suspended solids to form additional sludge deposits where fresh and salt waters meet.

Thus, these suspended solids may produce harmful effects throughout the entire length of the receiving streams from the points of discharge to their mouths.

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RULES AND REGULATIONS

* * *

The State Department of Health of the State of New Jersey pursuant to the authority vested in it by Chapter 177, Laws of 1947 hereby establishes the following Rules and Regulations for the administration of Revised Statutes 24:2-1 and 24:14-2. All prior Rules and Regulations in these matters adopted on various dates by the Department of Health of the State of New Jersey are hereby rescinded.

NEW JERSEY STATE DEPARTMENT OF HEALTH

By:

Roscoe P. Kandle, M.D.
State Commissioner of Health

Effective Date: January 1, 1967

Filed with the Secretary of State: December 15, 1966

* * *

The State Department of Health hereby condemns all oyster, clam and mussel growing areas or other places from which oysters, clams or other shellfish are or may be taken, at all times of the year except when otherwise noted, in:

1. General

   (a) all lagoons dredged for the purpose of providing access to property and/or the dockage of boats.

   (b) all marinas, boat yards, boat basins, harbors or other places where docking facilities are provided for boats.

2. Northern New Jersey Area

(a) all the waters lying west and north of Raritan Bay including: Raritan River, Arthur Kill, Kill Van Kull, Newark Bay, Passaic River, Hackensack River, Upper Bay, Hudson River and tributaries of the above bodies of water.

3. Raritan Bay Area

(a) all the waters of Raritan Bay and tributaries thereof.

(b) all the waters of Lower Bay and tributaries thereof.

(c) all the waters of Sandy Hook Bay lying west and north of a straight line beginning at Conover Light at Leonardo, N.J. and bearing approximately 46°T to Sandy Hook Lighthouse and; all the waters of Sandy Hook Bay south of a straight line beginning at the flashing green light at the end of the first spur of the Naval Ammunition Pier at Leonardo, N.J. bearing approximately 133°T to the flashing light at the eastern end of the Atlantic Highlands breakwater, then bearing 094°T across the southeast tip of the island at the mouth of Spermaceti Cove and terminating on Sandy Hook peninsula.

4. Shrewsbury River Area

(a) all of the Shrewsbury River and tributaries thereof (not including the Navesink River) lying south from the above described line in Sandy Hook Bay running from the Naval Ammunition Pier to Sandy Hook peninsula. At the confluence of the Navesink and Shrewsbury Rivers, the condemned waters shall be only on the east side of a line beginning at the most southerly tip of Lower Rocky Point and connecting the most easterly edge of the marshy islands in the mouth of the Navesink River then terminating on the mainland of Rumson Neck on the south side of the most southerly entrance to the Navesink River.

5. Navesink River

(a) all that portion of the Navesink River and tributaries west from a straight line beginning on shore at the pier at the Fairhaven Yacht Works bearing approximately 001°T to the mouth of the small creek on the opposite shore of the Navesink River.

(b) all that portion of the Navesink River contained within a line beginning at the southern terminus of

the Oceanic Bridge then running along the bridge to the main channel, then following the south side of the channel westward to flashing light #15, then bearing approximately 181°T to the point of land on the south bank of the Navesink River.

(c) all that portion of the Navesink River and tributaries contained within a line beginning at the southern terminus of the Oceanic Bridge and bearing approximately 65°T to the northwest tip of the small island southeast of flashing light #9 marking the Navesink River Channel, then bearing approximately 93°T to northernmost tip of Barley Point, then following the eastern shore of Barley Point to its southeastern point at the mouth of Black Point Creek, then bearing approximately 180°T and terminating on the mainland shore of Black Point Creek.

6. Shark River Area

(a) all of Shark River and tributaries.

7. Sea Girt Area

(a) all of Sea Girt Inlet.

(b) all of Wreck Pond and tributaries.

8. Manasquan River Area

(a) all of Manasquan River and tributaries including Stockton Lake, Watson Creek, Glimmer Glass, and Lake Louise.

(b) all of Bay Head - Manasquan Canal.

9. Bay Head Area & Metedeconk River

(a) all of Beaverdam Creek and tributaries and all of Metedeconk River west from a straight line beginning at Flashing Red light #10 off Perch Hole Point at the southern end of Bay Head - Manasquan Canal and bearing approximately 226°T to Flashing Red light #2 south of Wardell Neck, then bearing approximately 172°T through Flashing Green light #1 and terminating on the south shore of the Metedeconk River.

10. Island Beach Area - Bay Head to Seaside Park

(a) all that portion of Barnegat Bay and tributaries north and east of a line beginning at Flashing Red light #10 off Perch Hole Point at the southern end of Bay Head - Manasquan Canal, then running in a southerly direction to Flashing Red light #12, then to Flashing Red light #14, then to the northwest

tip of Herring Island, continuing along the shore of Herring Island to its southernmost tip, then bearing approximately 185°T to inland waterway marker 23, then following the east side of the inland waterway channel to can buoy "27", then bearing approximately 202°T to the most westerly point of land in "Curtis Point", then bearing approximately 189°T to the most westerly point of land just south of "Mantaloking Shores", then bearing approximately 213°T to Flashing Red light #2 off "Normandy Beach", then bearing approximately 169°T to the nearest island to the south, then along the shore of that island to its southeastern point, then bearing approximately 177°T to the east tip of the 2 islands off "Ocean Beach" continuing along the east shore of that island and the next island immediately to the south to its southernmost point, then bearing approximately 181°T to Flashing Green light #13 off Lavallette, then bearing approximately 234°T to Flashing Green light #11 off West Point Island, then bearing approximately 159°T to Flashing Red light #10 off West Point Island, then bearing approximately 187°T to the northernmost point of the marsh island to the south of that light, continuing along the shore of that island to its southernmost point, then bearing approximately 221°T to the westernmost tip of Pelican Island, then bearing approximately 130°T to Flashing Green light #3 off Seaside Heights, then bearing approximately 170°T to the southwest corner of the bulkhead west of Berkeley Yacht Basin, then bearing approximately 176°T to the western end of the municipal pier off 5th Ave. in Seaside Park, then bearing approximately 210°T to the western end of the municipal pier off 14th Ave. in Seaside Park, then bearing approximately 186°T to the next point of land, then bearing approximately 178°T and terminating at the next point of land at Island Beach State Park.

11. <u>Dover Township Area from Kettle Creek to Toms River</u>

(a) all of Kettle Creek and tributaries north and west from a straight line beginning at Seaweed Point and bearing approximately 241°T to Andrew Point at Green Island.

(b) all of Silver Bay and tributaries west from a straight line beginning at Andrew Point at Green Island and bearing approximately 206°T to the next point of land (Cattus Island).

(c) all of Applegates Cove and tributaries west of a straight line beginning at Tilton Point and bearing approximately 333°T to next point of land.

(d) all of Shelter Cove west from a straight line connecting the points of land at its mouth.

(e) all of Goose Creek and tributaries west from a straight line beginning at the southern point at the mouth of Shelter Cove and bearing approximately 195°T to the next point of land.

12. Toms River Area

(a) all of Toms River and tributaries west from a straight line beginning at Goodluck Point and bearing approximately 353°T to the most easterly point of land at "Windsor Park", north of the Mathis Bridge.

13. Berkeley Township Area - Toms River to Cedar Creek

(a) all the waters west from a line beginning at the northern tip of Berkeley Island, on the north side of Cedar Creek, and bearing approximately 294°T to the next point of land, closing off the first cove north of Berkeley Island, then bearing approximately 318°T to the next point of land, closing of the next cove to the north, then bearing approximately 351°T to the point of land on the north bank of Maple Creek, then bearing approximately 021°T to the most easterly of the small islands off the mouth of Clamming Creek, then bearing approximately 011°T to the most easterly point of land on the south bank of Potter Creek (Dicks Landing), then bearing 038°T to Flashing Red light #60 north of "Berkeley Shores", then bearing approximately 045°T to the eastern end of Barnegat Pier, then continuing in a generally northerly direction along the offshore ends of the piers and terminating on the north bank at the entrance to Goodluck Harbor Marina.

Cedar Creek (Lanoka Harbor Area)

(a) all of Cedar Creek and tributaries west from a straight line beginning at the southeasterly tip of Berkeley Island on the north side of the mouth of Cedar Creek and bearing approximately 185°T to the next point of land east of Flashing light #1 on the south shore of Cedar Creek.

14. Forked River Area to Barnegat (Double Creek) Area

(a) all those waters west from a line beginning at Flashing Red light #4 off the mouth of Forked River and bearing approximately 347°T to a point of land north of Forked River; also beginning at the same light the line bears approximately 219°T through Flashing light #3 marking the entrance channel at

Oyster Creek to the entrance channel at Holiday Harbor, then bearing approximately 187°T to the entrance channel at Waretown Creek, then bearing approximately 196°T to the entrance channel at Liberty Harbor, then bearing approximately 187°T to the entrance channel to Barnegat Beach, then bearing approximately 190°T to Flashing Red light #2 at the entrance to Double Creek, then bearing approximately 186°T to the point of land across the entrance to Double Creek, then bearing approximately 224°T to the next point of land to the southwest and continuing in a straight line to its terminus on the mainland.

15. Long Beach Island Area, Barnegat Light to Holgate

(a) all that portion of Barnegat Bay, south and east from a line beginning at Barnegat Lighthouse and running in a northwesterly direction to red nun buoy #4, then running in a southwesterly direction through Flashing light #1, then continuing in a straight line to its terminus on High Bar peninsula.

(b) all that portion of Barnegat Bay and Manahawkin Bay lying east and south from a line beginning at the western end of Arnold Rd. in High Bar Harbor and bearing approximately 217°T to the northeast point of the southernmost of the two islands just off shore, then along the east shore of that island to its southeast point, then bearing approximately 140°T to the most easterly tip of Vol Sedge, then along the east shore of that island and across to the southernmost tip of the other island of Vol Sedge, then bearing approximately 170°T to a point on the west side of the staked channel directly off the mouth of the lagoon at "Long Beach Club Estates", then bearing approximately 236°T to the west side of the staked channel around the outer perimeter of "Loveladies Harbor", then following the west side of that channel around to the southwest side of "Loveladies Harbor" until it intersects a straight line connecting Flashing Red light #2 off Harvey Cedars Harbor with Barnegat Lighthouse, then bearing approximately 204°T along that line to Flashing Red light #2, then bearing approximately 235°T toward Flashing Red marker #28 until it intersects a line connecting Barnegat Light and Woods Island, then along that line bearing 205°T to the westernmost tip of Woods Island which is adjacent to flashing light #85, then bearing approximately 112°T to the nearest point of land in Harvey Cedars, then bearing approximately 219°T to the next point of land, then bearing approximately 196°T to the point of land just north of Barbay Road in Long

Beach Twp., then bearing approximately 209°T to the end of the pier at the end of Bay Shore St. in Long Beach Twp., then bearing approximately 229°T to the pier at the end of N. 9th St. in Surf City (Surf City Yacht Club), then bearing approximately 239°T to the point of land at the end of N. 3rd St. in Surf City, then bearing approximately 263°T to a point of land on Cedar Bonnet Island, then along the north shore of that island and across the entrance to the two cuts into the island and terminating on the northwest bank at the entrance to Barnegat Isle Marina.

(c) all that portion of Manahawkin Bay and Little Egg Harbor lying east and south from a line beginning at the southeast tip of Cedar Bonnet Island and bearing 181°T to Flashing Red light #8, then continuing to Flashing Green light #9, then continuing to Flashing Red light #34 marking the intracoastal waterway, then bearing approximately 198°T to the small island inshore from channel marker #36, then continuing to Flashing Red light #38, then following the west side of the intracoastal waterway to Flashing Red light #44, then in a straight line to Flashing Green light #47, then in a straight line to Flashing Green light #53, then continuing in a straight line to channel marker #54 and then following the west side of the intracoastal waterway to Flashing Red light #64, then bearing approximately 239°T to the southernmost tip of the small island off the Beach Haven Yacht Club, then bearing approximately 226°T to the northernmost tip of Mordecai Island, then along the shore of that island to its southwest point, then bearing approximately 267°T to Flashing light #75, then bearing approximately 191°T to a point of land, then continuing along the shoreline to the southwest closing off the entrances to Tebco's Boat Basin and Silver Sands Marina, then from the bulkhead at the end of Inlet Drive, the line bears 215°T and terminates at the point of land on the south side of Holgate.

16. <u>Beach Haven West - Mallard Island Area</u>

(a) all of Cedar Creek and Manahawkin Creek north and west from a line beginning on the northern bank at the entrance to Cedar Creek and bearing approximately 150°T to a small island, then bearing approximately 209°T to the western end of the most westerly island along the Manahawkin Causeway, then bearing approximately 173°T to the most easterly tip of Thorofare Island, then bearing 218°T toward the "Fish Factory" on Seven

Islands in Great Bay for a distance of approximately 750 yards until it intersects a line beginning at Flashing Red light #28 marking the inland waterway and bearing approximately 275°T toward Flashing light #1 off Cedar Run Cove. The condemned area boundary continues along said line bearing 275°T for a distance of approximately 1100 yards until it intersects a line beginning at the next point of land west from Popular Point and bearing approximately 214°T toward the above mentioned "Fish Factory". The condemned area boundary then continues along said line in a northeasterly direction and terminates at the point of land where the line begins.

17. Cedar Run Area (Seasonal)

(a) all of Cedar Run and tributaries west from a straight line across the creek bearing 210°T from Flashing Red light #2 in Cedar Run.

(b) all of Cedar Run Cove lying between the above described line and a straight line beginning at Horse Point and bearing approximately 037°T to a point of land on the opposite side of the cove shall be condemned from May 1 through October 31 of each year and approved for the harvest of shellfish from November 1 through April 30 of each year.

18. Westcunk Creek

(a) all of Westcunk Creek and tributaries west from a straight line across the creek beginning at Flashing light #1 at the mouth of Westcunk Creek and bearing approximately 006°T to the southern point at the mouth of Dinner Point Creek.

19. Tuckerton Area (Seasonal)

(a) all of Tuckerton Creek and tributaries north and west from a straight line beginning at Flashing light #17 at the mouth of Tuckerton Creek and bearing approximately 073°T to a point across Tuckerton Cove.

(b) all of Tuckerton Cove lying between the above described line and a straight line connecting Thorofare Point and Gaunt Point shall be condemned from May 1 through October 31 of each year and approved for the harvest of shellfish from November 1 through April 30 of each year.

20. Atlantis and Mystic Isles Area

(a) all of Big Thorofare and tributaries.

(b) all of Big Creek and tributaries.

21. Mullica River - Great Bay Area

(a) all of Bass River and tributaries.

(b) all of Nacote Creek and tributaries.

(c) all of Mott Creek upstream from a straight line beginning at Flashing Red light #2 at the mouth of Mott Creek and bearing approximately 226°T to the opposite shore of the creek.

(d) all of Oyster Creek and tributaries.

22. Reed Bay Area

(a) all the waters north and west of a line beginning at the most southerly point of land on the west side of Somers Cove and bearing approximately 215°T terminating on the mainland southwest from the mouth of Conover Creek.

(b) all of Conover Creek and tributaries.

23. Brigantine Area

(a) all of Golden Hammock Thorofare.

(b) all of Bonita Tideway but not the creeks between Bonita Tideway and Eagle Bay.

(c) all of Baremore Quarters.

(d) Wading Thorofare from Bonita Tideway and Baremore Quarters northwest to a line beginning at Flashing Red light #6 and bearing approximately 196°T terminating on the opposite shore of Wading Thorofare and another line beginning at Flashing red light #6 bearing approximately 041°T terminating on the opposite shore of Obes Thorofare.

(e) all of Black Hole.

(f) all of Low Water Thorofare

24. Atlantic City - Absecon Area

(a) all of Absecon Inlet.

(b) all of Absecon Channel south and west from a line across Middle Thorofare beginning at Debs Point and bearing approximately 056°T through Inland Waterway Channel marker #73 terminating on the opposite shore; and south and west from a line across the southeast entrance to Wills Thorofare including; Mankiller Bay and Point Bar Thorofare.

(c) all of Absecon Bay south and west from a line beginning at the southwest bank of the northwest entrance to Wills Thorofare bearing approximately 305°T and terminating on the mainland east of Absecon Creek.

(d) all of Absecon Creek.

(e) all of Jonathan Thorofare.

(f) all of Newfound Thorofare.

(g) all of Duck Thorofare.

(h) all of Clam Thorofare and the canals in the Venice Park section of Atlantic City.

(i) all of Clam Creek and contiguous harbors.

(j) all of Beach Thorofare from Absecon Channel to Great Egg Harbor Inlet.

(k) all of Inside Thorofare and West Canal.

(l) all of Great Thorofare.

25. <u>Pleasantville - Northfield - Linwood - Margate Area</u>

(a) all of Lakes Bay.

(b) all of Shelter Island Bay.

(c) all of Lakes Channel.

(d) all of Dock Thorofare and tributaries.

(e) all of Stillman Creek.

(f) all of Mulberry Thorofare and tributaries.

(g) all of Risley Channel.

(h) all of Shelter Island Waters.

(i) all of Whirlpool Channel.

(j) all of Scull Bay.

(k) all of Sod Thorofare and tributaries.

(l) all of Broad Thorofare and tributaries.

(m) all of Hospitality Creek.

(n) all of Beach Thorofare as specified in Atlantic City Absecon Area.

26. Ocean City - Somers Point Area (Seasonal)

(a) all of Great Egg Harbor Inlet.

(b) Rainbow Channel northeast from the Ocean City - Somers Point Bridge.

(c) all of Rainbow Thorofare northeast from the Ocean City - Somers Point Bridge.

(d) all of Elbow Thorofare and Ship Channel north and east from the Ocean City - Somers Point Bridge within a line beginning at Anchorage Point and bearing approximately 210°T to the southeasterly end of an un-named island, then along that island to its opposite end, then bearing approximately 190°T to the largest of the Rainbow Islands, then along the shore of that island to the Ocean City - Somers Point Bridge, then along the bridge to Somers Point, then along the shore of Ship Channel, across the entrance to Bass Harbor and continuing to its starting point at Anchorage Point shall be condemned for the harvest of shellfish from May 1, through October 31 of each year and approved for the harvest of shellfish from November 1, through April 30 of each year.

(e) all of Bass Harbor from Ship Channel to a line beginning on the southeast bank at the mouth of a ditch opposite the southeast side of an island at the entrance to Steelman Bay and bearing approximately 300°T terminating on the opposite side of Bass Harbor.

(f) all of Steelman Bay and the tributary on the northwesterly side of the bay north and east from the line specified in section (e) above,

shall be condemned for the harvest of shellfish from May 1, through October 31 of each year and shall be approved for the harvest of shellfish from November 1, through April 30 of each year.

(g) all of Patcong Creek and tributaries upstream from a line beginning at Channel Marker Fl "1" bearing approximately 110°T and terminating on the opposite side of Patcong Creek.

(h) all of Beach Thorofare from Great Egg Harbor Inlet to a line beginning at the southwest point of Shooting Island bearing approximately 169°T and terminating on the opposite side of Beach Thorofare, including the waters south and east from a line beginning at Inland Waterway Marker Fl R "12" bearing 040°T passing through Channel Marker Fl R "6" and terminating on the island northeasterly from Fl R "6".

(i) all of Peck Bay contained within a line beginning on the northerly point at the mouth of the unnamed ditch at Golders Point and bearing approximately 125°T to Shooting Island, then along the shore of Shooting Islands to and along the line described in section (h) as bearing 169°T from the southwest point of Shooting Island, then along the east shore of Peck Bay to and along a straight line transecting Peck Bay passing through Inland Waterway Marker "29" bearing approximately 306°T, then in a northerly direction along the west shore of Peck Bay to its beginning at Golders Point shall be condemned for the harvest of shellfish from May 1, through October 31 of each year and shall be approved for the harvest of shellfish from November 1, through April 30 of each year.

(j) all of Peck Bay south and west from the line transecting Peck Bay through Channel Marker "29" bearing 306°T described in section (i) above.

(k) all of Crook Horn Creek from Peck Bay to Middle Thorofare.

(l) all of Upland Thorofare and tributaries.

(m) all of Beach Creek.

27. <u>Great Egg Harbor River (Seasonal)</u>

(a) all the waters of Great Egg Harbor River and

tributaries between a straight line beginning at Channel Marker Fl G "5" bearing approximately 93°T and terminating on the opposite shore of Great Egg Harbor River and a line beginning at the point of land on the west bank at the mouth of English Creek and bearing approximately 149°T to the point of land on the opposite side of Great Egg Harbor River shall be condemned for the harvest of shellfish from May 1, through October 31 of each year and shall be approved for the harvest of shellfish from November 1, through April 30 of each year.

(b) all of Great Egg Harbor River and tributaries upstream from the line at English Creek described in section (a) above.

28. Tuckahoe River

(a) all the waters of Tuckahoe River and tributaries upstream from a straight line beginning on the east bank at the mouth of Job Creek bearing approximately 23°T to the island off shore along the shore of the island and terminating on the opposite bank of the Tuckahoe River.

29. Sea Isle City Area

(a) all of Maple Swamp (both branches) including the cove at the mouth.

(b) all of Big Elder Creek.

(c) all of Little Elder Creek.

(d) the waters of Ludlam Bay south and west from a line beginning on the northwesterly point at the mouth of Maple Swamp, bearing approximately 130°T and terminating on the southerly side of Ludlam Bay.

(e) all of Ludlam Thorofare from Ludlam Bay to Townsend Channel.

(f) all of Sunks Creek and tributaries not including Ware Thorofare

30. Avalon Area

(a) all of Avalon (Canfield) Canal.

(b) all of Cornell Harbor.

(c) all of Pennsylvania Harbor.

(d) all of Princeton Harbor.

(e) all of Graven Thorofare and tributaries.

(f) all the stream between Avalon (Canfield) Canal and Long Reach.

(g) all of Ingram Thorofare and tributaries from the Avalon Road bridge southwesterly to a straight line beginning at the point of land at the confluence of Long Reach and Ingram Thorofare, bearing approximately 35°T terminating at the point of land at the confluence of of Ingram Thorofare and Deep Thorofare.

(h) all of South Channel from a straight line beginning at the point (on the un-named island) of confluence with North Channel, bearing approximately 138°T terminating on the opposite side of South Channel in a westerly direction to a straight line beginning on the northeast bank of the west entrance to South Channel (on the small island), bearing approximately 246°T terminating on the mainland at the entrance to Leonard Thorofare.

(i) all of Leonard Thorofare in a southerly direction from the line specified in section (h) above (bearing 246°T).

(j) Deep Thorofare from a straight line beginning on the northern bank at the entrance to Cat Run and running across Deep Creek to the northern bank at the entrance to Leonard Thorofare. (Cat Run is not condemned) to a line across the mouth of Deep Thorofare at Paddy Thorofare meeting the northeast end of the line across the mouth of Ingram Thorofare.

31. <u>Stone Harbor Area</u>

(a) all of Gull Island Thorofare, Cresse Thorofare and Great Channel south and east from a straight line beginning at Halfmile Point, bearing approximately 110°T passing across the northern tip of Gull Island and terminating on the easterly bank at the entrance to Sturgeon Hole to a straight line transecting Great Channel beginning on the southwest bank at the entrance to a small ditch on the northwest shore of Great Channel near inland waterway marker #80 bearing approximately 126°T passing across the island and terminating on the opposite shore of Great Channel.

(b) all that body of water running parallel with Seven Mile Beach, not including tributaries.

(c) all of Oldman Creek.

(d) all of Oyster Creek.

(e) all of Scotch Bonnett.

(f) all that creek connecting Oyster Creek and Scotch Bonnett.

(g) all of Muddy Hole.

(h) all of Stone Harbor Canal.

(i) all of Hetty Creek.

(j) all of Crooked Creek.

(k) all of Mulford Creek and the creek connecting it with Crooked Creek.

32. Jenkins Sound (Seasonal)

(a) all that portion of Jenkins Sound contained within a line beginning at the end of Shellbed Landing Road, bearing approximately 093°T to the northwest tip of the nearest island, then bearing approximately 046°T to the nearest point of land on the opposite side of Nichols Channel, then bearing approximately 305°T to the northern bank at the mouth of the creek north of Benny's Landing; shall be condemned for the harvest of shellfish from May 1, through October 31, of each year and shall be approved for the harvest of shellfish from November 1 through April 30, of each year.

33. The Wildwoods Area

(a) all of Hereford Inlet lying south from a straight line connecting the most southerly tip of Nummy Island and the most southerly tip of land on the north side of the inlet.

(b) all of Grassy Sound Channel and tributaries not including Jenkins Channel.

(c) all those waters lying between North Wildwood Blvd. and Jenkins Channel and Jenkins Sound including Gravelly Run and Turtle Gut.

(d) all of Beach Creek and tributaries.

(e) all of Grassy Sound and tributaries.

(f) all of Turtle Thorofare and tributaries.

(g) all of Tempe Creek and tributaries.

(h) all of Cresse Creek and tributaries.

(i) all of Richardson Sound and tributaries.

(j) all of Post Creek and Ottens Harbor and tributaries.

(k) all of Sunset Lake and tributaries.

(l) all of Richardson Channel and tributaries.

(m) all of Swain Channel and tributaries.

(n) all of Taylor Sound and tributaries including Jones Creek.

(o) all of Reubens Thorofare and tributaries.

(p) all of Jarvis Sound and tributaries.

34. Cape May Area

(a) all of Upper Thorofare and tributaries.

(b) all of Middle Thorofare and tributaries.

(c) all of Lower Thorofare and tributaries.

(d) all of Cape May Inlet (Cold Spring Inlet).

(e) all of Cape May Harbor (Cold Spring Harbor).

(f) all of Skunk Sound and tributaries.

(g) all of Cape Island Creek and tributaries.

(h) all of Cape May Canal and tributaries.

35. Delaware Bay Area

(a) all that portion of Delaware Bay contained within a line beginning at the pumping station at the mouth of Fishing Creek, Cape May County

and extending into the bay for one nautical mile on a bearing of 295°T, then continuing on a bearing of approximately 196°T to Fl. light #5 at Crow Shoal, then continuing to Cape May Lighthouse and terminating. The closure includes all tributaries flowing into the above described area including Fishing Creek, Cox Hall Creek and Pond Creek.

(b) all of Dias Creek.

(c) all of Bidwell Creek and tributaries shall be condemned for the harvest of shellfish from May 1, through October 31, of each year and shall be approved for the harvest of shellfish from November 1, through April 30, of each year.

(d) all of Dennis Creek and tributaries including Roaring Ditch upstream from a line beginning on the southwest bank at the entrance to Roaring Ditch and bearing 149°T to the opposite shore of Dennis Creek. That portion of Dennis Creek downstream from the above described line shall remain approved for the harvest of shellfish.

(e) all of East Creek and tributaries.

(f) all of Riggins Ditch and tributaries.

(g) all of Maurice River and tributaries and that portion of Maurice River Cove north and east from a straight line known as the "Summer Line" beginning at the lighthouse on East Point and bearing 311°T to a marker on the western bank at the mouth of New England Creek.

(h) all of Dividing Creek and tributaries upstream from a line beginning on the northerly bank at the entrance to Hansey Creek and bearing 217°T to the opposite shore of Dividing Creek. That portion of Dividing Creek and tributaries downstream from the above described line shall remain open for the harvest of shellfish.

(i) all of Fortesque Creek and tributaries from the mouth to the confluence of each of its branches with Oranoaken Creek. Oranoaken Creek shall remain approved for the harvest of shellfish downstream from "The Glades".

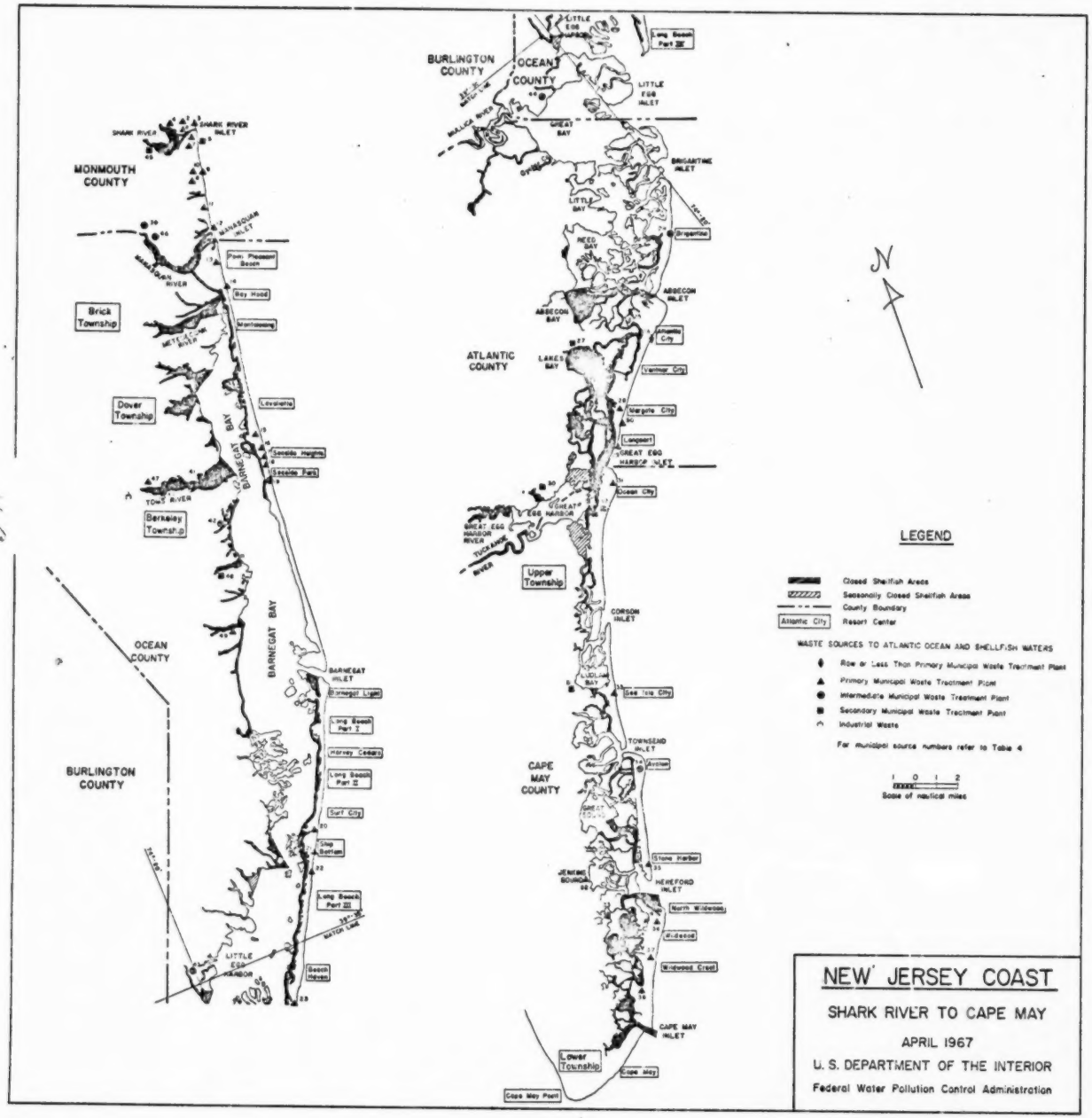
(j) all the waters known as The Glades north from their confluence with Weir Creek, including that

portion of Oranoaken Creek north from Weir Creek. Weir Creek shall remain approved for the harvest of shellfish.

(k) all of Nantuxent Creek (Cumberland County) and tributaries upstream from a straight line beginning at the Fl. light on the southern bank at the mouth of Nantuxent Creek and bearing approximately 003°T to the mouth of the small ditch on the opposite shore of Nantuxent Creek.

(l) all of Cedar Creek (Cumberland County) and tributaries upstream from a straight line beginning at the point of land on the southern bank and the entrance to Cedar Creek and bearing approximately 003°T to the opposite shore of Cedar Creek.

(m) all of Cohansey River and tributaries upstream from a straight line beginning at the most easterly point of land on the island at the mouth of Cohansey River and bearing 330°T to the opposite shore of Cohansey River and from a straight line from the outer range light marking the entrance to Cohansey River to the most westerly point of the same island.


MONMOUTH COUNTY
Brick Township
Dover Township
Berkeley Township
OCEAN COUNTY
BURLINGTON COUNTY
BARNEGAT BAY
BURLINGTON COUNTY
OCEAN COUNTY
ATLANTIC COUNTY
CAPE MAY COUNTY
Upper Township
Lower Township
LEGEND
Closed Shellfish Areas
Seasonally Closed Shellfish Areas
County Boundary
Resort Center
WASTE SOURCES TO ATLANTIC OCEAN AND SHELLFISH WATERS
Raw or Less Than Primary Municipal Waste Treatment Plant
Primary Municipal Waste Treatment Plant
Intermediate Municipal Waste Treatment Plant
Secondary Municipal Waste Treatment Plant
Industrial Waste
For municipal source numbers refer to Table 4
Scale of nautical miles
NEW JERSEY COAST
SHARK RIVER TO CAPE MAY
APRIL 1967
U. S. DEPARTMENT OF THE INTERIOR
Federal Water Pollution Control Administration

GPO 956-459